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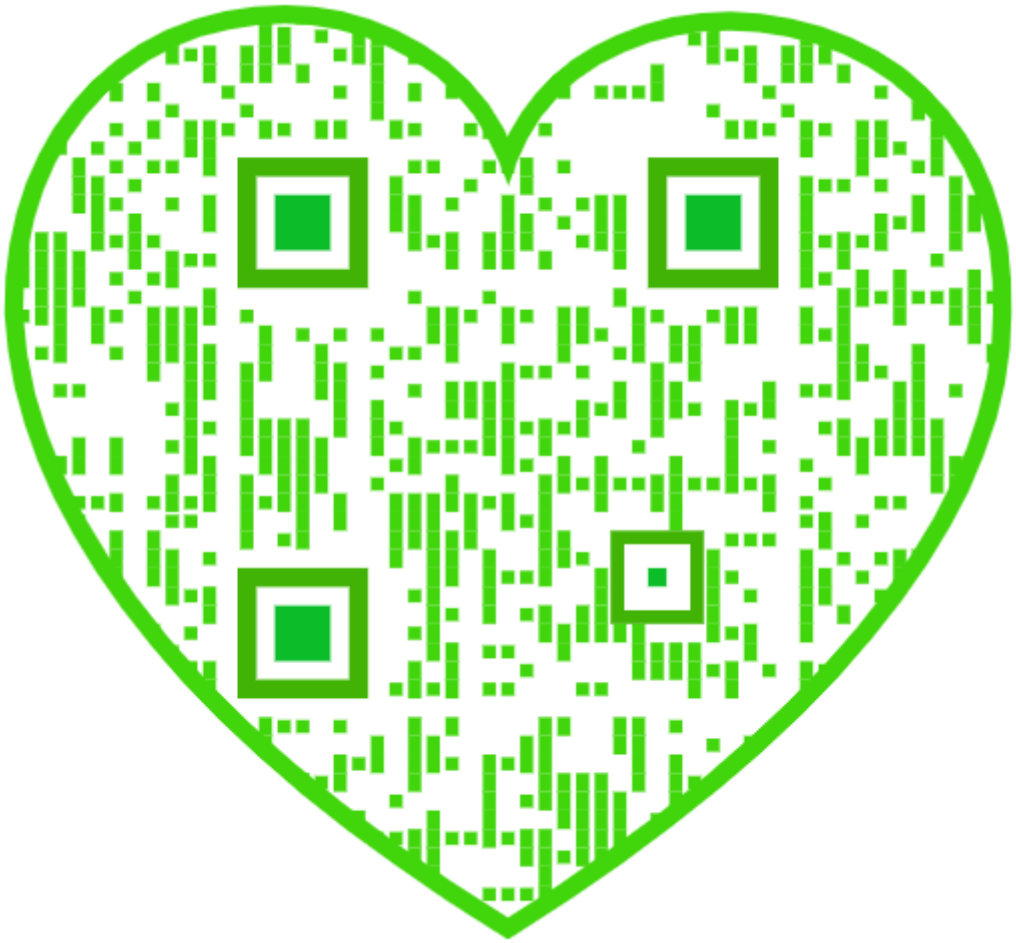

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UNITED STATES OF AMERICA.

SILK CULTURE

BY

MRS. M. C. BUCKNER,

PRESIDENT

WOMAN'S SILK CULTURE ASSOCIATION

OF ILLINOIS.

SILK CULTURE:

A

MANUAL WITH COMPLETE INSTRUCTIONS

IN

SERICULTURE.

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ADDRESS ALL COMMUNICATIONS TO

MRS. M. C. BUCKNER,

CORNER BUCKNER AND RAVINE AVENUES, EAST BLUFF, PEORIA, ILLINOIS.

PRICE TWENTY-FIVE CENTS.

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MRS. M. C. BUCKNER,

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"*The Prosperity of a Nation Depends upon the Industries of Its People.*"

WITH THE ABOVE SENTIMENTS THIS BOOK IS RESPECTFULLY DEDICATED TO

MISS LILLIAN THEILIG.

INTRODUCTORY.

In this year, 1885, as the labor question is agitating the people, the idea forcibly presents itself that the masses would be greatly benefitted if their attention was turned to industries that would give employment to the women, children, and the aged. I have been making careful researches, and find a new industry which has proved successful in many of the States — Silk Culture. Though new to us, it is very old. It is comparatively unknown in this country, though in Europe and Asia it has long been their cheif source of income. That it is a profitable industry is shown by the prosperity of those nations engaged in it. The silk culture of to-day is not what it was fifty years ago. Then we had no manufactories. The United States has between three or four hundred silk mills at the present time, and the supply is far from filling the demand. In such an emergency we have to look to other countries for supplies. The demand for American silk is steadily increasing. An extensive dealer in silks in our city said he would patronize American productions in future, as foreign silks cannot be relied upon. He should add (as should all other merchants of prominence) we demand the products be raised in this country. Why should we not raise silk here? It requires the poorest land to raise the best mulberry leaves: we have ready and willing workers to commence this work, who are non-producers. Says one: Silk culture will never be a success in this country on account of the cheapness of labor in Europe and Asia. It is to the women of our nation we appeal. To you and your little ones it offers employment. The

work is light and easy, requiring great patience and skill. It demands the strictest attention, and should never be left to hired help. People are won to love the culture of this little insect. We want to awaken the enthusiasm of our people, that they may work for the success of this great and lucrative industry. We have few avenues of appropriate industries for women. It was by a woman that the art was first discovered, and woman it principally adorns, and by woman let it be produced. The production of silk has millions of dollars for the willing workers among our fair daughters of America. In rearing the silk worm there will be blunders at the start, and there will also be failures, as there is in many other enterprises. I should in no instance advise new beginners to undertake silk culture on a large scale. If they do so they will certainly meet with failure. The knowledge of the work is easily acquired, but to insure success education in the art, though we gain our knowledge by experience, is necessarily important.

Silk culture flourishes equally as well north as south; it is said the finest silk in the world is produced in the north. Silk was used for musical strings 3,400 years before our Christian era. The Empress Si-Ling-Shi discovered silk worms spinning their cocoons on the mulberry trees in the northern part of China, in the province of Tartary, 1600 years before Christ; some writers claim 2600 years before our Christian era. To a few public-spirited persons does this infant industry owe its existence in this country. If disease ruin the precious crop it is owing to our own carelessness. Silkworm eggs of inferior breeds will not pay for the trouble. Diseased eggs, brought from irresponsible persons, produced through ignorance of the best selection of cocoons for parents, poor food, bad ventilation, want of cleanliness:— these are causes of failure in the silk crop. It is of the very first importance to the success of silk culture that there be no disease among the worms. The most careful precautions should be taken against hatching eggs that are in any way affected. For this reason there should be no eggs raised by inexperienced persons, as the people are as yet ignorant of what

is good or bad. All the cocoons should be stifled and dried and sold for reeling. Eggs should only be raised by persons who understand the business thoroughly. In California, to insure the healthy condition of the eggs and moth before distribution, they are all microscopically examined by noted scientists, Dr. Behs and Dr. Harkness, or by other competent gentlemen selected for that purpose by the health committee, and all possible care is taken to insure their excellence.

A very few years ago it was not thought possible that the silkworm could be raised in the north. Now that that question has been forever settled, it remains with the women of our nation to make silk culture a profitable industry. The time for the care of the little laborers is so short, and the work so light compared with many other industries of life, that with perseverance, knowledge, experience and thrift we will make it a success. There are many obstacles to be overcome in silk raising, and the greatest of these is the want of knowledge. Silk culture in its many phases is rich with profit to our people. May we see the day when America will be noted for her healthy silkworm eggs, in which France has been for thirty years deficient. The noted scientist, Pasteur, has been employed by that government for many years to discover the cause of the blight, but so far has been unsuccessful. It may be on account of the overcrowded condition of their conntry. We may yet furnish the world with silkworm eggs. It is truly wonderful for persons of leisure to follow day after day the rapid progress of this little insect in its transformation into chrysalis, enclosed in a silken envelope so closely sealed that we cannot tear it asunder, though apparently without exertion comes a beautiful silken moth, the last transformation of the insect. I do not think people undertaking silk culture will realize a profit the first year, and for that reason they should not experiment on over one dollar's worth of eggs. With that amount, with careful watching they will gain experience that will enable them to try more an other year. During this time the trees are growing if planted out, and by the time they are in

full bearing of leaves the knowledge required will be attained to make silk culture a success. If we learn a trade we cannot expect to realize a profit from our labor until the knowledge we seek is attained. The same in the poultry business: if an inexperienced person uudertakes the business with one thousand fowls, in all probability they will fail; but let new beginners start with one dozen fowls and they will be almost sure of success. It is the same with the silkworm; each family can produce a few pounds of cocoons, and that will soon create a market at home, the same as our grain market. Filatures will be established to prepare the cocoons for the manufactories. The care of the silkworm, and the reeling of the precious filer constitutes a very light and easy employment. The work once understood, women and children will readily betake themselves to it. A more suitable employment is never likely to present itself. Let us then commence the work at once by making preparations. The cost is but a trifle. If we should fail we have at least gained some experience. Then we can try again. We are bound to succeed if we have patience and perseverance.

The Chinese and Europeans gave up this art of silk raising with great reluctance. Many a lot of silk-worm eggs shipped to this country at great expense has been found upon trial to be purposely spoiled. The opposition has not ended here. The powerful interests these countries have taken to discourage the industry and sale of cocoons that have been raised here with our manufactories has been very marked. Take it all in all, silk culture has and is having a great struggle for transplantation in our American soil. Home inexperience and foreign jealousy have for a time nearly ruined silk culture. But let us now hope it is entering upon an era of prosperity. It remains with the women of our nation to make it such. We must join hand in hand in this great work. The north, south, east and west must work as one. We want to make a market in our little city, lying in the center of the most productive part of the northwest. We expect in the not far-off future to see it teeming with manufactories and spinning mills. We have an

abundance of coal and water, and our railroad facilities are as good as any in the west. All we want is to keep our people encouraged in the work. If cocoons are produced in sufficient quantities to warrant it manufactories will follow. Silk culture will give our daughters a spirit of independence. She need not leave home to find work in our now over-crowded cities. With this work understood she can earn more in the few weeks employed in it than she can earn in one year in the city. This industry, when it becomes universal, there will be filatures established, that women and girls will find work the year round. California has been the first State in the Union to provide a filature and a market for the cocoons raised in the State. It is the first State in the Union whose Legisture has come forward and assisted the people to establish filatures in their midst. This is what the people want is a market. They would willingly buy silk-worm eggs and mulberry trees, but want a place to sell the cocoons after they are raised. It is no benefit for the government to make appropriations in money and give it out in eggs and trees and leave the cocoons in the people's hands. Filatures should be established in every State in the Union, and should be supported by the government. In the old established silk-growing countries all receive more or less aid from their different governments.

Girls and women could be taught to reel where filatures are established, and could earn one dollar per day in their own homes reeling cocoons. They could first raise the cocoons and then reel them, giving them employment the year round.

We should in every part of the country foster this industry; we have eager, anxious women that would be glad of this kind of work, but they lack the courage to undertake it. Woman and woman's work is one of the great questions of the day. She has ever been dependent though her share of toil has been heavy, and it is very important that she should share in this very appropriate industry.

It is said small silk raising of from fifty to three hundred pounds of cocoons is a success most to infallible, when undertaken with sound eggs and best mulberry leaves; while on a large scale, to the inexperienced, it is sure to be a failure. For the prosperity of the silkworm and most favorable to health is dry atmosphere, plenty of air and warmth, and above all cleanliness and plenty of food. Senator Mitchell, of Pennsylvania, said with a little encouragement we can carry this industry into all the homes of the farmers of this country, and our productions would largely exceed that of Asia, which is now one hundred and twenty millions of dollars annually.

In France forty million of dollars are earned annually by their women in silk culture. Many of the women of Italy depend upon the culture of silk for a living. Lombardy, a small province in Southern Europe, exports thirty million dollars' worth of raw silk, besides furnishing their own immense manufactories, which work is done by their women. Those immense sums of money sent to foreign nations for raw silk should be kept at home and go into the hands of the women of the United States. Some of the wives and daughters of the nobility of Europe have their royal cocooneries, and every year in the month of May ladies of high rank, with their maids, are busy in the work of silk culture as the poorest peasants. The pleasure of the undertaking pays those ladies of rank. We do not advise the cultivator of the soil to give up his farm for silk culture, but we do advise him to plant and cultivate a small portion of it to mulberry trees, so that his wife and daughters can have a lucrative employment as well as himself.

SILK CULTURE IN THE UNITED STATES.

Silk culture was first introduced in North America in 1522, by Cortez. He ordered the planting of mulberry trees, the truth of which has been established in consequence of a litigation arising therefrom showing what had been done by the first board of auditors. One quarter of an ounce of silkworm eggs was charged to them from the crown of Spain, selling them at the rate of sixty dollars per ounce. They were given into the hands of a man without principle who, though successful in raising the crop, returned only two ounces. He sold the surplus for his own benefit. It will be at once seen that speculators existed at that early day. In 1609 King James I., of England, urged upon the American Colonists, by the English officials, for the promotion of silk culture in order to supply their manufactories with the raw material. In 1822 England not receiving what she thought the country capable of producing offered rewards to the willing and punishment to the disobedient who would or would not prosecute this industry. In 1523 the Legislature of Virginia offered rewards of fifty pounds of tobacco for every pound of reeled silk produced in the State, and levied a fine of twenty pounds of tobacco to all planters who neglected to plant the mulberry tree. Afterwards bounties were offered as follows: In 1656 four hundred pounds of tobacco to all planters that would continue in the business of silk farming.

In 1657 the crowned heads of England and all the nobility were determined, no matter at what sacrifice to the infant colonies, their silk mills should be supplied in order that they could adorn them-

selves in silken robes, which were at that time worn by both men and women. The Legislature of Virginia, through the urgent solicitation of the King, therefore offered additional premiums of ten thousand pounds of tobacco to any planter who would raise and send to England £200 worth of raw silk; also five thousand pounds of tobacco to any person producing one thousand pounds of wound or reeled silk. In 1662 fifty pounds of tobacco was given as a reward for every pound of raw silk. In 1693 North and South Carolina were engaged in the culture of silk. The village of Silk Hope at that time came into notice, and gave fair promise of future growth and prosperity. In 1718 the industry drifted into Mississippi, but there is no record of their success. In 1726 England received quantities of beautiful silk raised in Pennsylvania. In 1732 the culture of silk was carried on to a considerable extent in Connecticut. President Styles, of Yale College, experimented with three mulberry trees for a number of years, rearing and caring for the silkworm. A quarto volume of his in manuscript, the title being "The Growth, Treatment and Product of the Silkworm," which is still in good preservation in the library of that college. In 1795 the mulberry tree was planted in Georgia by Oglethorpe. He successfully raised silk, as he presented Queen Caroline with eight pounds of raw silk from which was made a silken robe and hose, and worn by Charles II., at his coronation. In 1755 the Princess Dowager and Lord Chesterfield arrayed themselves in silk raised in America. Prior to this, Queen Charlotte, on the King's birthday, is said to have worn a dress made wholly from American grown silk.

The records go to show that the industry among the colonists found favor on the Atlantic coast and Gulf of Mexico, but ere silk culture became firmly established it failed. Various reasons are attributed as to the failure of the establishment of silk culture in the United States. One great reason was the absence of manufactories here and England's arbitrary oppression of the American colonists. At an early day the governments of Europe were

opposed to the manufacturing of silk in America. England imposed heavy penalties on all shipmasters who should convey to this country any implement of any kind pertaining to the manufacture of silk. They allowed no expert in the art of silk weaving to settle here. England wished to consume all raw silk raised in the colonies to keep her own manufactories in motion. This resulted in disaster to the colonies. As the war of the Revolution came on the people were deprived of a market. Silk culture then slumbered for fifty years. When Hon. Mr. Miner, of Pennsylvania, introduced the subject in Congress in the year 1825, it was referred to the Agricultural Department. A committee was chosen to act on the matter and the result was six thousand copies of a silk manual was ordered printed for free distribution.

Up to the year 1839 silk culture was favorably received The people then became excited and many entered wildly in the speculation. All kinds of business was forsaken, and the raising of silk was undertaken on an extensive scale without any practical knowledge of the work. Unprincipled speculators were everywhere rife in the land. They promised large returns to the cultivator; they induced the people to believe there was speedy and great wealth. Each hoped to become a millionaire. Stock companies were organized with officers at ruinous salaries, who did not understand the work, and their untruthful statements increased the excitement. The silk yields of the past was greatly over-estimated. The returns in silk from egg cocoons and mulberry trees was greatly exaggerated. The result was many people lost their all.

Since the failure of 1839 silk culture has existed only in the homes of a few, for their own use in making silk thread and mixing the fibre with wool and manufacturing into homespun garments. In the homes of the farmers and villagers, where land is cheap, and with the best breeds of silkworms eggs, and best variety of white mulberry trees, and when handled with knowledge and care, silk culture will pay the same as dairying or poultry raising. When silk culture becomes universal we will have steady markets through

all the country, the same as we have for any marketable produce. Home comforts are mostly derived from honest toil, which is generally remunerative. We need never expect to grasp riches from this industry, but it will be something to add to other industries. The time required for the work is so short, and the labor so light with the proper food and conveniences, that more money can be made, considering the time required, than at most any other industry; but to be successful we must prosecute the industry with care, and learn by actual experience. It is with small beginnings greatness is sometimes attained.

Parents in the country should provide remunerative labor for their grown-up daughters. The men of our nation have a duty to perform, and without their aid their wives and daughters are, in a measure, helpless. It is their duty to plant and cultivate the mulberry tree convenient to their houses, and then this industry can be managed by the women, the children, and the aged. California has at the present time one hundred filatures or reels in operation, and has a steady market for all cocoons raised in the State. Her people went to work with a will, receiving assistance and encouragement from her legislature, which enabled a few devoted and determined people to encourage this industry. They have started several manufactories: one for weaving silk dress goods, and another for making sewing and knitting silk. Only four short years since they undertook the work, and now thousands of their people are busily employed. They have asked their legislature to make further appropriations this year and next, and after that they think their filatures will be self-supporting. Their climate is not one whit better than ours for the purpose of silk raising; their people in no more need of employment than we of the Northwest, and our legislature is amply able to assist in establishing filatures. Would that we could but get the people united and interested in this great industry. At San Francisco the art of reeling is taught to any woman or girl that makes application, free of all expenses.

It takes about two months to become an expert reeler, and after that time they become teachers or reel for wages. Their wages average one dollar per day. The great object in California is to instruct young girls, that they may be able to reel marketable silk at home: first to raise the cocoons, and then to reel them. In this way they can have lucrative employment at home the year round.

FOOD FOR THE SILK WORM.

Food is one of the first considerations in silk culture. It should be convenient and abundant. The white mulberry tree leaves are natural food of the silkworm. Of this tree there are many varieties. The Lou, or Lou Sang, is one of the best, and originated in the province of Lou, in China. This tree answers best for the south. It produces large, soft, tender leaves, as large as a dinner-plate, easily gathered, and grows rapidly from cuttings. Another variety, also a southern tree, is called Nagasaki, or Japonica. This tree is so expensive, and no better than the Lou, I have not thought proper to advise the culture of it at present, until it gets cheaper. It bears large, strong silk-making leaves, and grows from cuttings. The Rose is hardy, can stand the frosts of our Illinois winters as far north as the State extends, bears large leaves several inches each way, and produces a most beautiful silk. The leaves pick very easily. The Moretti leaves are a little hard to pick, and are not so large as the above-named, but is hardy, and thrives well in a northern climate. The Russian Albia is another extremely hardy tree, and makes the best of silk. All the above varieties are white, and all grow readily from cuttings. I should advise hedge planting for mulberry cuttings for silk farming under all circumstances for new beginners. The cuttings should be planted in rows, and tended as corn is cared for. Cuttings can be taken from the first planting the second summer and rooted. When three years old they can be set in an orchard if preferred. The mulberry tree will thrive on any soil that is not marshy. In planting the best mulberry cuttings as

I have described, in hedges, and kept well trimmed, and all dead wood cleared away, the shoots long and full-leaved, one person can pick one hundred pounds an hour. The hardy mulberry tree grows equally as well in Minnesota as in Florida. There are two distinct varieties, the white and black, from which many varieties come. The black mulberry yields a great quantity of excellent fruit, but makes a coarse and unsaleable silk. The white mulberry grows, when planted in orchards, to a great hight and size. The leaves, which produce a most beautiful silk, are very glossy on the upper side and smooth on both sides. The berries on these two varieties of trees present various shades, from jet black to pure white. They are a lucious fruit for table use. The wood of the white mulberry is very compact and is capable of taking a fine polish. As an ornamental tree it cannot be excelled. It should have a place on roadsides and public grounds. Its lofty height and brilliant foilage gives it a pleasing appearance. Mulberry trees could be raised from seeds, but it would be well to graft them, as seeds yield different varieties of trees, which takes time and expense, when cuttings at small cost, would produce the same tree. The cuttings grow so rapid after the first year cuttings can be taken from them as they will need pruning. Be sure in getting cuttings or rooted trees to get of the best, as silk cannot be successfully raised on poor mulberry leaves as they produce poor silk, and the profit is all lost in the difficulty of gathering the small tough leaves. The rooted mulberry trees will come too expensive where acres would be planted. I advise new beginners at all times to procure a few cuttings of the best white mulberry. The ground should be plowed or spaded very deep and thoroughly harrowed or raked until all is smooth. The cuttings should be from six to eight inches in length, set in rows eight feet apart. The dirt should be pressed firmly around the lower end of the cutting, the upper part covering the cutting almost wholly with loose earth, in order to protect the buds from the sun's rays. Plant in rows far enough apart to admit the the plow and cultivator, which should be used freely. Be careful

not to disturb the young roots. In securing healthy shrubs they must be cut back every spring when many shoots from the roots will spring forth producing great quantities of leaves, which are easily gathered in bags or baskets. The situation for the mulberry should be high land, well drained. Dry sandy soil is preferable. Low, rich, moist land never produces nourishing leaves, however vigorously the trees may grow.

In planting mulberry trees in open ground the trees may be planted at the usual distance of apple trees. The intervals may be cultivated in vegetables. Every farmer knows the importance of cultivating young trees and securing them to stakes to insure an upright, straight growth, and to prevent them being shaken by the wind or leveled by storms. One acre of best white mulberry cuttings planted in a hedge as I have described, will yield in two years after planting in spring, 8,000 pounds of leaves which will feed five ounces of silkworm eggs after hatching. These at nominal prices would bring two hundred and fifty dollars net.

Food is the first matter of importance in sericulture, which must be good, abundant and convenient to cocoonery. The best breeds of silkworm eggs and best care will prove a success, otherwise a failure. The best period of raising silkworms will be from the tenth of May until the tenth of July. It is a very particular little insect, and will make its choice from what it shall make its winding sheet of glossy golden thread, which is the one purpose of its useful brief life. It will bear with no imposture in the adulteration of its food. Lettuce or cabbage leaves may be tolerated for a while, but the fifth age of the worm requires the best silk-making food.

Those having inferior mulberry trees can improve them by grafting with a superior kind. The tree after the first year must be carefully trimmed to secure a rich healthy leaf. Much depends upon the pruning. The mulberry tree leaves to make good silk must contain different substances; among them are coloring matter, fibrous material, resinous or silky matter and saccharine. The sac-

charine and resinous matter is indispensible; the former nourishing the worm and the latter contains the silk-making fluid. The yield of silk will be determined by the amount of saccharine and resinous matter contained in the leaves from which the worm derives its food. The mulberry trees I have named are each rich in resinous and saccharine matter. The time of pruning the mulberry is most any time after the leaves are gathered. All unsightly or crooked limbs must be cut away and endeavor to give the tree a neat appearance. The grounds should be kept clear of grass and weeds, and well cultivated. The tree should be trimmed more or less every year. On a well trimmed tree which yields large rich leaves, they can be gathered in one-quarter of the time it takes to gather inferior leaves of a mulberry that pick hard, or Osage Orange leaves. One object is gained in well-trimmed trees in passing the half-closed hand upwards along the shoots — large quantities of the rich luxuriant leaves can soon be gathered. The tree should never be allowed to grow over ten feet in height so that the uppermost limbs can be drawn down and the leaves easily secured. Mulberry trees should be planted on highways, in public parks, around school houses, in cemeteries, or wherever there is public ground, in order that poor people could raise the silkworm. I think it would be preferable to almshouses, as many could then support themselves.

COCOONERY.

This expense is easily avoided, as a room in the house or in an outbuilding can be used to advantage. The eggs of the silkworm are so small, not larger than a mustard seed, and when we take into consideration the growth of the worm, space must be allowed accordingly. When the worm reaches maturity they are about three inches in length. Ample ventilation must be secured to the worms or disease will attack them. The appliances used in a cocoonery are called rack, frames and trays. To construct the rack, use inch by inch and a half lumber, ten feet in length, two feet and a half wide, and six feet high. Have ten pieces of the ten-foot lumber, the same quantity of the two-foot and a half, and fasten together on the six-foot posts, which are eight in number, at equal distances with screws, brace at the top and bottom of each end, and the rack is completed. The trays, twenty in number to fill the rack, will be two feet three inches in width by four feet in length, made from half inch boards, three inches wide, dressed, braced at the four corners, with narrow strips nailed across the bottom to hold it firm. The frames are made to fit nicely in the trays, of narrow half-inch stuff, halved at the four corners, and clinched with very small wrought nails. Cover these with coarse musquito netting, and have forty of them. As the worms grow and get too large for the netting it can be removed, and wrapping cord can be crossed and recrossed round and round the frame. Tack strips of leather on each end of the frames to remove them by. A nail can be driven through each corner of the frame to prevent them resting too heavily upon the

worms. On a rack of this size can be reared one half ounce of eggs. No mating boxes are needed ; if you wish to make one take a pasteboard box and place partitions through it, or put the silk moths in small pasteboard boxes, but I think that to lay them on a table answers every purpose. Any person can construct the racks, trays and frames.

For few worms there is not much needed. As the cultivator advances in the art new ideas will present themselves. Two such racks as I have described can be set in a room fifteen feet square, and one ounce of silkworm eggs can be raised in that space. It would be well to tack very loose, open muslin over the windows, and take out the sash in daytime, to admit all the air possible, and close them at night if cool, leaving space for ventilation always. In case of storms of heavy thunder close the shutters and windows while it lasts. Always remember that proper ventilation the worms must have for fear of disease. When silk-raising becomes universal, as I believe it will, it may then be necessary to construct some kind of a building to be used as a cocoonery, and as the life of a silkworm is short, it would be advisable to make it convenient for other purposes. It could be constructed so as to answer the balance of the year for a hay barn. The silkworms would have spun their cocoons before the hay would be gathered in. In any case, either for house or barn, the frames I have described would be suitable for any building. The larger the building the more could be made, and they are so simple anyone can construct them. A building 20 by 40 would have the capacity for rearing one hundred thousand worms.

CARE OF THE SILKWORM.

Procure eggs in December, January, February, March or April. If the weather should be very warm the middle of April will be as late as it would be safe to order eggs, as they may hatch on the road. Keep them in a cool dry place where water will not freeze. It is best to place them in a tin box with close fitting cover, punctured with small holes for the purpose of ventilation. When the leaf on the mulberry tree is as large as a one cent piece, place your eggs on a table in a room with temperature from sixty-five to seventy degrees. Great care should be taken to see that it is so regulated. Silkworm eggs should be hatched where the air is moist. I should advise in the selection of eggs to choose Crozier's yellow, as they produce the largest amount of silk and finest quality. With best of care they will yield one hundred pounds of cocoons to one ounce of eggs green. The White, from Bagdad, a very fine cocoon, yields from eighty to one hundred pounds per ounce of eggs. When the eggs assume a whitish hue the worm is formed. When hatched give a few tender leaves finely chopped; feed frequently, but a little at a time. When two days old place coarse mosquito netting over them. Sprinkle the leaves evenly over the netting, through which the worms will readily crawl. As the worms grow the threads can be pulled out each way of the netting, which gives plenty of room for the worms to creep through. Keep each day's hatch by themselves, or if you have but few keep the first hatched in a cooler temperature; give but few leaves (though in putting in a lower temperature will retard appetite), and

keep them there until a second and third lot of leaves are secured in the same way. This done bring all in a warmer room; feed up as if all were the same age. By this means they will be brought through all the molts at the same time. If two crops are desired keep back your annuals. When your first begin to spin bring up your eggs you have kept back. When you have raised your first crop your own good sense will teach you how to proceed — experience is our best teacher. The first age or molt. The apartment must be light, but the sun must not shine on the worms in any stage. Feed the worms with the most tender leaves four or five times a a day in small quantities chopped fine. On the fourth day the skin becomes hazel-color and looks skinny, heads enlarge and assumes a silvery bright appearance. These are marks of their approaching first change. On this day the appetites of the worms begin to decrease preparatory to their first molting, and their food must be diminished. In the course of the fifth day all the worms become torpid. During this period and in the subsequent moltings, they must not be disturbed. Second molt: The two first meals of the first day should be less plentiful than the last meals of the first day, and must consist of the most tender leaves. The litter can be removed but not thrown away, as many worms cling to the old leaves. Those must be continued until after the third molt. If between moltings any appear sick, they must be removed to another room where the air is pure and a little warmer. Give them fresh leaves and they will soon revive. On the third day the appetites of the worms will be visibly diminished, and in the course of it many will become torpid; the next day all are torpid, and on the fifth day all will have changed their skin. The color of the worms in the second age becomes a light grey. Third age or molt: The revived worms are known by their new aspect. Feed as before in first and second molts. The litter should be removed, the room thoroughly cleaned to insure the healthfulness of the worms. Fourth age: widen the space for the worms. The food is to be greatly increased on the third and fourth days; on the fifth less will be required, as in the

course of this day many become torpid. The first meal on this day should therefore be the largest. On the sixth day they will want less, as nearly the whole day will be occupied in effecting their last change of skin. Cleanse the room thoroughly. If the evenings be cool after a hot day close up the shutters, but always have pure fresh air. None but full-grown leaves should now be given them. On the seventh day all the worms will have roused and thus finish the fourth age. Fifth age, or until the worms prepare to spin: the constitution of the worms being now formed they begin to elaborate, the silk vessels fill with silky material. Give now an abundance of room, do not let the worms lie so close as to touch each other. Continue to feed in abundance as the appetites of the worms become voracious — give food all they can eat, the last meal late at night, and the first the next day early in the morning. They need no further care during the night than this. In this age depends wholly upon the firmness of your cocoons. If worms have been well fed and are in good health, cocoons should reel from one thousand to twelve hundred yards.

Temperature is very important in sericulture first to the egg, then the worm throughout its short existence. Thermometers should be studied constantly; they should not rise above seventy-five during the feeding period. I believe there is more danger from too great heat than cold.

Continuation of the fifth age: This is the time destructive disease attacks them. Be sure your leaves are free from dust, dew or dampness. Do not feed any tender leaves in this age, but the largest and firmest, and there should no change be made in the variety of their food. They should never be allowed to be without food. The trays should be kept thoroughly clean. Moderate the temperature of your room, if too hot, by wiping the floors with ice-water; if too cool, by building a little fire.

On the seventh day of the fifth age they have attained their largest size, three inches in length, and begin to grow skinny and yellow. The litter must be kept removed, but must be done so

carefully as not to disturb the worms. The preservation of the proper temperature of the apartment at this stage cannot be too seriously impressed upon the cultivator. If sudden heat should take place, as often happens at this time, serious loss may be suffered without proper precautions. The increased heat to which the worms are exposed causes them to cease eating, to wander about in order to find places to form their cocoons in before the silk fluid has been fully matured, thus defeating in a great measure, all the care previously bestowed upon them. Sudden changes, either hot or cold, are very injurious in this stage. The fifth age can only be looked upon as terminated when the cocoon is perfected. About the tenth day of the fifth age the worms attain perfection, which may be ascertained by the following indications:

First, when putting some leaves on the frames the worms get upon them without eating, and rear their heads as if in search of something else. Second, when looking at them horizontally the light shines through them, and they appear of a whitish yellow transparent color. Third, when they begin to wander. Up to this time they have been contented on the trays. When those signs appear in any of the insects everything should be prepared for their rising, that those worms that are ready to rise may not lose their strength and silk in seeking the support they require. Handle the worms with the greatest care and gentleness, as the slightest pressure injures them. They should always be handled with different-sized camel hair brushes. Bunches of oat straw, cornucopias of paper, and small branches of trees, could be prepared for worms that are wanting to spin. These could be carefully placed over their feeding frames, when they will immediately rise. Should any commence spinning too close together they should be removed, as the doubles are worthless for reeling. When the worms are forming their cocoons the greatest silence should be preserved, as they are very sensitive to noise, and if disturbed will for a moment cease to spin, then the continuity of the thread will be interrupted and the value of the cocoon diminished. During the whole life of the silk-

worm no noxious smell should be allowed in the cocoonery, and no dust should be made. The floors must be wiped over with a damp cloth to remove the dust.

First, to gather the cocoons; second, to choose the cocoons which are to be preserved for eggs; third, preservation of cocoons until the appearance of the moth. First—strong, healthy, well-managed silkworms will complete their cocoon four days at the farthest, calculating from the moment when they first begin casting their floss. This period will be shorter if silkworms spin the silk in a higher temperature than that which has been indicated, and in very dry air. It will be better not to remove the cocoons until the sixth or seventh day from the time the first worm commenced to spin. They may be removed on the seventh day with safety if the time be known with certainty.

GATHERING COCOONS AND MARKETING.

Begin at the lower tier of trays and remove the cocoons carefully. All the cocoons that want a certain consistency and feel soft, and all doubles, should be laid aside that they may not be mixed with the better ones. When a basketfull is obtained empty them on the feeding trays, cover them with paper on the bottom and sides. When the cocoons are detached the down or floss in which the silk worms formed the cocoons should be taken off. If the cocoons are for sale alive, weigh them and send them to the purchaser; if within one or two days journey it is preferable to have them alive, as many get soiled at home and therefore do not bring so good a price.

To pack cocoons for shipping — fresh, live cocoons must be sent by express in perforated wooden boxes or in tightly shut baskets, well filled up, to prevent shaking on the road. One hundred pounds for box or basket is not too much for one day's traveling. Twenty-five to fifty pounds can travel four days by express without damaging. Cocoons can be shipped in well filled boxes or barrels by freight, to any distance after stifling. Stifling or killing the chrysalis should occur on the sixth or seventh day. The best mode for small quantities — put as large a kettle on the stove as you have filled with boiling water. Have ready your cocoons in a steamer tightly closed, steam twenty minutes. When the chrysalis is quickly and thoroughly killed, lay in the sun, stirring frequently until thoroughly dried. Those not having the means of reeling their cocoons a few days after they are perfected, or selling them, will

have to kill them, or they will eat through and spoil the cocoons. The surest and best mode of stifling the chrysalis is to do it by steam. Those having large quantities, and steam mills are convenient, could be stifled in boxes contrived for the purpose, subjected to steam. Care should be taken that cocoons do not mould. When killed spread out on shelves or trays in a well ventilated room to dry, as where there are large quantities the trouble would be too great to remove them out- and in-doors. Stir them frequently for the first week, and afterwards every day for six weeks. When thoroughly dried they are ready for market. The boxes and barrels they are packed in should be weighed and their weights marked thereon, in order to ascertain the weight of the cocoons after they are packed. Put the inferior cocoons in packages by themselves. Great care should be taken that none are jammed or cracked — such injury would destroy their value for reeling. Rats, mice, ants, moths and other insects, must be guarded against. When packing the cocoons sprinkle camphor gum finely pulverized or tobacco stems occasionally through the packages. It requires about thirteen pounds of green cocoons, or four and one-third pounds of dry, to yield one pound of raw or reeled silk. It is estimated that the waste in floss doubles cocoons, and will about pay for reeling. About twenty pounds of the best mulberry leaves fed to the silk-worm will make one pound of silk.

EGGS FOR HATCHING.

Choosing the Cocoons for the Production of Eggs.—A female silk moth will lay from two hundred to four hundred eggs (some say six hundred). Select the small cocoons of a straw color with hard ends and fine webs, and which are a little depressed in the centre, as if tightened by a string; these are to be preferred. There are no certain signs to distinguish the sexes. The best known are the following: The smaller cocoons, sharper at both ends, and depressed in the center, generally produce the males. The round full cocoons, without ring in the center, usually contain the female. However, all marks may fail. An extra number may be kept to insure success in hatching.

Preservation of Cocoons intended for Eggs.—Experience shows that where the temperature of the room is over seventy-three degrees the transition of the chrysalis to the moth state would be too rapid, and the coupling would not be productive. If below sixty-six degrees the development of the moth would be tardy, which is also injurious. Damp air will change it into a weak and sickly moth. The apartment should be kept at an even dry temperature, between sixty-six and seventy-three degrees. When collected then spread the cocoons on a dry floor or a table, and strip them clean of floss or down to prevent the feet of the moth from becoming entangled in coming out. Select the best, and those that have any defects should be laid aside. This is the time to separate the male from the female cocoons so far as we can distinguish them. Select an equal number of males and females, and keep the cocoons of the

same day's rising separate, that the moths may pierce them at the same time. If the cocoons taken from the whole are mixed, and selection made for those intended for breeding from the general heap, many will be set aside which were made by worms that had risen to spin on different days, and which will be pierced by moths unequally, and hence there will not be an equal number of males and females produced at the same time. This irregularity may cause the loss of a great many moths, or several thousand eggs. When the selection has been made, the sorted cocoons can be placed in pasteboard boxes put on an incline. It would be beneficial to stir them round once a day if the air be moist. If the seed cocoon be not very numerous they may be strung on a thread and hung against a wall. Pierce the cocoons in the centre with a needle just sufficient to attach the thread, as it cannot be ascertained at which end the moth will pierce the cocoon. Place a male and female alternately upon the thread, that they may be near each other when they come out, though many writers advise the separation of the moths for an hour after hatching, that the female may discharge a viscid liquid from her body. Should the temperature of the room rise to seventy-eight or eighty degrees the cocoons must be removed to a cooler temperature. The formation of the moth, and its disposition to issue from the cocoons, may be ascertained when one of its extremities is perceived to be wet, which is the part occupied by the head. A few hours after, and sometimes in one hour, the moth will pierce through the cocoon and come out. If the surface on which the cocoons are laid is rough the moth will issue with greater ease. The life of the moth lasts from five to eight days. They eat nothing while in this state. The moths begin, from the time they commence to spin, to come forth from twelve to fifteen days. The room in which the moths are produced should be darkened, or at least have only sufficient light to distinguish objects. This is an important rule, and must be carefully attended to. The hours when the moth bursts the cocoon are from six to ten in the morning. The male moth, from the moment he issues from the cocoon, goes eager-

ly in quest of the female. They should be coupled six hours, after which time they may be gently separated, by taking them by the wings and body and pressing the male very carefully away from the female. It is easy to ascertain if there are more females than males. The body of the female is nearly double the size of that of the male, besides, the male beats about its wings, and is in a continual flutter until mated. If there be an excess of females, males must be allotted which have already been in a state of union. Those eggs will be found equally fertile. It is the general practice not to use the male for another female, but it has been tested, in the event of there being more female than male moths, the latter may be used to profit. Eggs have been known to be fertile up to the sixth coupling of one male to that number of females. The moths from time to time must be looked after, in case some become separated that they may be united again in order to secure the fertility of the eggs. Six hours, as has been said, is the usual time for the moths to remain united, for in this time the eggs of the female become fully impregnated. Cloth is considered best for receiving the eggs, as they are more easily removed from it. If you do not wish to remove the eggs tissue paper is very nice to use, cut in small squares, pinned to a cloth hung on an incline. In using cloth or paper it should be weighed and the weight marked thereon. After the eggs are laid it will be an easy matter to discover the weight of the eggs. Place the females, beginning at the top, and going downwards give room for the reception of at least four hundred eggs, which, as soon as laid, will fasten securely to whatever they come in contact with. They are at first of a pale-yellow color, afterwards becoming a blueish gray. If they do not attain that hue, but remain yellow, they are supposed to be unimpregnated. Silkworms properly treated will never degenerate. The eggs that have been laid within ten or twelve hours are all that should be preserved. If the females lay their eggs evenly distributed, and quickly, and they retain their weight after drying, they are considered good. Preserving the eggs is of the utmost importance. There are many ways described by

different writers, but the best way I have found is as heretofore described. Place them, after being thoroughly dried, in a tin box having a close-fitting cover punctured with small holes, in a cool, dark, dry place. It is best to have the box made with a handle that can be hung on a nail to one of the joists in the cellar, and left there until hatching time. They should be placed in the cellar as soon as the middle of September or the first of October at the latest. The temperature should not fall below thirty-two nor rise above fifty-five degrees.

Silkworm eggs for a time are seemingly lifeless, and they will stand a much greater degree of heat than that required to hatch them in the spring. They should be looked after during the summer, and carefully guarded against rats, mice, roaches and ants, if they are where they have access to them they will soon destroy them. More than one crop of silkworms in a season I do not recommend, as they never pay for the trouble. The annuals hatch once a year. The bivoltins twice a year; the last hatched must be kept for another year. In no way can the first hatched be kept for another year, for they will hatch or die. The trivoltins three crop. The quadrivoltins four crop. It has long been decided that the many crop is a failure. The annuals are the best crop, and there are many of those that are worthless.

DISEASES OF THE SILKWORM.

Diseases, as among other animals or insects, silkworms are not exempt. Among the most frequent diseases are the yellows, which is caused in the last stages by excessive heat. They become very much swollen and discharge a poisonous watery substance that sickens all that comes in contact with it. Cool the atmosphere of the rooms, remove all diseased worms and cleanse the room thoroughly. Use chloride of lime or carbolic acid in wiping everything in the apartment. Flacherie or blight are the diseases that have made such sad ravages in France for so many years. In the year 1853 France raised twenty-six million kilogrammes of cocoons. Three years later, in 1856, on account of this dread disease, the production fell to five million kilogrammes. A French kilogramme equals two pounds and a quarter avoirdupois.

Pebrine can be observed by the following symptoms: The worms hatched and fed at the same time have an uneven development. They do not molt at the same time. It is scarcely noticed in the first molt. Healthy worms show a ferocious appetite after molting. Others remain inactive, eat very little and grow slowly. They will be found on examination to be covered with small black spots; they should be removed and buried, as it is supposed they are poisonous to others. Over-crowding on the frames is injurious. Diseases more frequently attack the worm in the latter stages of life; they often spin their cocoon when diseased. When the moth comes out it is also diseased and is transmitted to the eggs, through the eggs to the nest-hatching. In this way disease will be perpetuated.

When worms are found sick throw them away, or better burn them. The frames and trays should be washed and scalded and then fumigated with brimstone. Procure healthy silkworm eggs, give good ventilators, keep the room at an even temperature; do not let cold drafts of air come upon them. If the weather becomes cool build a little fire; give plenty of light, but be careful the sun does not shine upon them; plenty of fresh clean leaves that grow in high dry land, free from dust — if dusty must be wiped off or washed and dried. In the last stages never leave withered leaves or excrement on the frames.

Leaves that have any defects should in no instance be fed to the worms. When leaves are gathered they should be thrown in your basket loosely; if packed tight they will ferment and become sour, and will be unfit for use. It is of the utmost importance to the success of silk culture in the United States that new beginners should not raise eggs for a year or two. If disease should make its appearance just at this time the people would become discouraged. Eggs should be first-class in quality as well as health.

A FILATURE.

A Filature is a reeling establishment where a number of persons reel silk on reels driven by steam power, under the direction of a superintendent, who, with a vigilant eye, watches the operations of the reelers in order that they may produce that great uniformity in the thread which makes the silk first class, or classical, and this silk is of the highest value in the market.

"The great object in reeling is to get the threads uniform, rounded, well joined, properly freed from moisture, and so crossed on the reel that they will not stick or glaze, as it is termed. These objects are attained by twisting, and the to-and-fro lateral movement of the reel, as also by properly regulating the distance between reel and basin. The uniformity of the thread depends on the skill of the operator, who must supply a new thread as soon as one begins to give out. This is called nourishing the silk, and is done by dexterously casting, with the thumb, the new thread upon the combined strand, to which it immediately adheres. In this the reeler must use much judgment, for the silk of a cocoon gets lighter and finer as it approaches the end.

"Whenever the silk rises in locks the temperature of the water is known to be too hot, and when it unwinds with difficulty the temperature is, on the contrary, too low. The operator is supplied with a skimmer with which to remove all chrysalides and refuse silk; also, with a basin of cold water in which to cool her fingers, which are being constantly dipped in the hot basin.

"The thread of silk as it unwinds from the cocoons is valueless for manufacturing purposes, as only several of them combined make the staple of commerce.

"The persons employed in unwinding silk are mostly girls, one sitting before each basin, of which she has charge. The basin is made of copper, and the water is heated by steam at the control of the operator. The cocoons are plunged into the water when it is near boiling point and moved about so that the gum which fastens the threads becomes uniform and thoroughly softened. They are then beaten with a small broom having the tips split, so that the loose threads readily fasten to them. After beating about a short time, the operator gets all the cocoons fastened, and taking the bundle of threads, shakes the cocoons until each hangs but by a single one; she now takes up five or six threads, according to the quality of silk wanted, unites them, and introduces the combined staple or strand into a little glass eye on one side of the basin. She then forms a second similar strand and introduces it into a second eye on the other side. The strands are then brought together, twisted several times, separated above the twist, and introduced into two other glass eyes or ringlets, through which they are led one to each end of the reel or tambour, which is kept revolving in a steady, rapid manner, and to which is also given a certain back-and-forth side motion."

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